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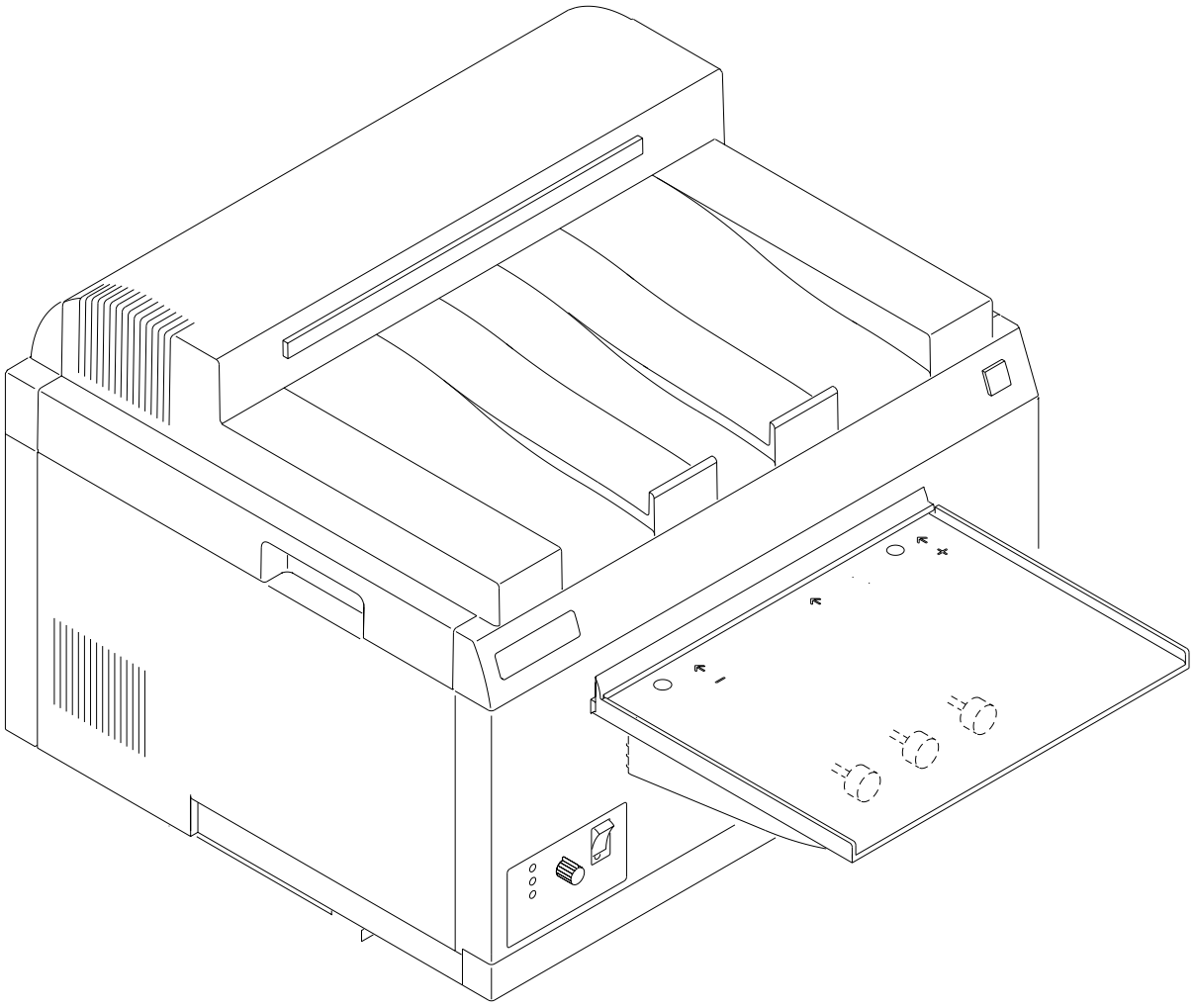
THEORY GUIDE for the *Kodak X-Omat* M43 and M43A PROCESSORS and the *Kodak X-Omat* Clinic 1 PROCESSOR



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HEALTH SCIENCES DIVISION

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Section 1: Introduction

Product Description

The *Kodak X-Omat* M43, M43A, and Clinic 1 PROCESSORS are compact, table-top PROCESSORS used for processing medical x-ray films. The *Kodak X-Omat* M43 and M43A PROCESSORS are designed to perform primarily in the professional, hospital satellite market. The *Kodak X-Omat* Clinic 1 PROCESSOR is designed to perform primarily in the professional, non-hospital market. The PROCESSOR uses ROLLER transport technology to reliably process sheet film in sizes ranging from 10 x 10 cm to 43 x 137 cm (4 x 4 to 17 x 54 in.).

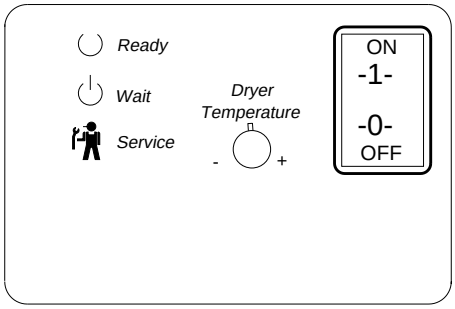
The PROCESSOR is simple and easy to use. It requires minimal operator intervention. Operator controls consist solely of an ON/OFF POWER SWITCH and a DRYER TEMPERATURE CONTROL KNOB. The PROCESSOR also has a DISPLAY PANEL that allows the operator to monitor the status of the PROCESSOR. Located on the DISPLAY PANEL are 3 STATUS INDICATORS that provide additional operator information about the operating status of the PROCESSOR.

READY The READY INDICATOR illuminates when the PROCESSOR is ready to accept film.

WAIT The WAIT INDICATOR illuminates or blinks when the PROCESSOR is not at its optimum operating condition. The WAIT INDICATOR illuminates and does not blink when you feed film.

SERVICE The SERVICE INDICATOR illuminates or blinks when the PROCESSOR has a more serious error. In this condition, the PROCESSOR may not accept film depending on how serious the error is.

Figure 1 **Identifying the STATUS INDICATORS**



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Product Features

The processing cycle of the *Kodak X-Omat* M43, M43A, and Clinic 1 PROCESSORS is short and efficient. The "drop time" for a 35 x 43 cm (14 x 17 in.) sheet of film from "leading edge in" to the "trailing edge out" is just over 2 minutes (127 seconds) assuming that the film is fed 43 cm (17 in.) wide.

Features found on the PROCESSOR include:

- Replenishment Check Mode - which allows you to easily check and reconfigure the volumes of replenishment solutions
- DEVELOPER TEMPERATURE DISPLAY (M43 and M43A Models) - which displays the temperature of the developer solution
- Water Recirculation System - which reduces the amount of water consumed
- Automatic Exit from Standby Mode - which eliminates the need for the operator to press a RUN BUTTON before the PROCESSOR will process films
- Flooded Replenishment Mode - which maintains the stability of the chemical solutions by automatically replenishing the processing solutions for low film usage applications.

In addition to the benefits provided by the features listed above, the M43, M43A, and Clinic 1 PROCESSORS provide further benefits to the installer. The M43, M43A, and Clinic 1 PROCESSORS are simple and easy to install. If the installation site meets all the requirements outlined in the Site Specifications, Publication Number 981087, no additional exhaust venting is required.

Model Information

Use the table below to determine which PROCESSOR model is right for your operating conditions.

Table 2 Selecting the Correct Model

Model	Voltage	Amperage	Frequency	Film Volume
M43A	Nominal 115 volt	20 amp	50/60 Hz	Medium
Clinic 1	Nominal 115 volt	20 amp	60 Hz	Low
M43	Nominal 230 volt	10 amp	50/60 Hz	Medium

Optional Accessories and KITS

MOUNTING STAND: Order CAT No. 808 1176 for the *Kodak* M35, M43, Clinic 1 MOUNTING STAND. The STAND offers the following benefits:

- provides a sturdy work surface for the PROCESSOR
- occupies a minimum of space
- positions the PROCESSOR at a convenient height for feeding films
- offers the convenience of a slide-out SHELF in the BASE for storing replenishment SUPPLY TANKS
- simplifies through-the-wall PROCESSOR installations

LIGHTTIGHT FEED TRAY: Order CAT No. 188 0355 for the optional LIGHTTIGHT FEED TRAY KIT. The LIGHTTIGHT FEED TRAY allows you to turn on the darkroom lights immediately upon feeding the last sheet of film.

TRANSFORMER KITS: Order CAT No. 167 4340 for the 115 V AC TRANSFORMER KIT, or CAT No. 171 0292 for the 230 V AC TRANSFORMER KIT. The KIT is available for sites that do not meet the voltage specifications as outlined in the Site Specifications, Publication Number 981087. Use of this KIT brings the voltage within the acceptable operating range.

- Clinic 1 and M43A voltage range is 115 $\pm$11.5 V AC
- M43 voltage range is 230 $\pm$22 V AC

SEISMIC ANCHOR BRACKET KIT: Order Part No. 261413 for the SEISMIC ANCHOR BRACKET KIT. The KIT is available for areas with high likelihood of seismic activity. The KIT allows you to attach the MOUNTING STAND securely to the floor. You can also use the KIT to anchor the PROCESSOR to a table top. Always install the KIT according to local codes.

VENT DUCT ADAPTER KIT: Order CAT No. 143 4943 for the VENT DUCT ADAPTER KIT. The KIT is available for sites that do not meet the specifications outlined in the Site Specifications, Publication Number 981087, and therefore require auxiliary venting. The ADAPTER attaches to the PROCESSOR and provides a FLANGE for connecting a 7.62 cm (3.0 in.) DUCT. The KIT facilitates the routing of an EXHAUST DUCT to an external ventilation source to remove fumes from the darkroom. If no exhaust is available, you can use this KIT with the *Kodak* AUXILIARY VENTILATION FAN KIT.

***Kodak* AUXILIARY VENTILATION FAN KIT 115 V AC:** Order Part No. 264503 for this KIT. The KIT is available for sites that do not meet the specifications for room air changes as outlined in the Site Specifications, Publication Number 981087. The KIT is available for 115 V AC installations only.

***Kodak X-Omat* Clinic 1 Installation KIT:** Order CAT No. 863 2754 for all of the components necessary to properly install a Clinic 1 PROCESSOR. The parts contained in this KIT are included with the PROCESSOR when you purchase either the M43 or the M43A model.

***Kodak X-Omat* M43 PROCESSOR Through-the-Wall KIT:** Order CAT No. 871 3109 for the Through-the-Wall KIT. This KIT includes the components and instructions necessary to install the PROCESSOR properly through the darkroom wall. This KIT assumes the use of the *Kodak* M35, M43, and ClinIc 1 MOUNTING STAND.

Section 2: Basic Principles of Film Processing

The Process

Film processing can be divided into 4 basic parts:

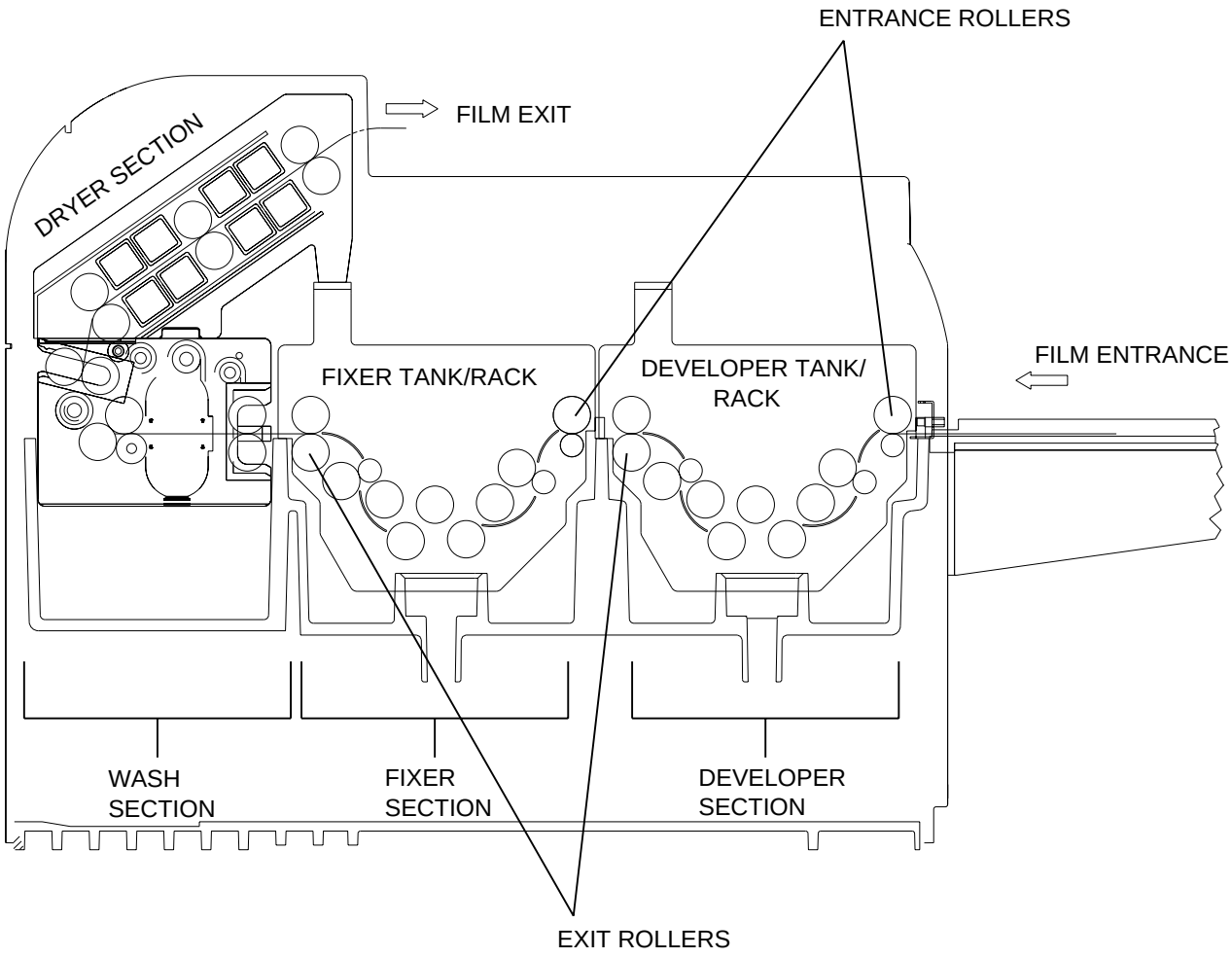
Developing	In the developing stage of the process, developer solution converts the invisible latent image on the film to a visible image.
Fixing	In the fixing stage of the process, fixer solution stops the continued development of the visible image by removing the unexposed silver halide crystals from the film.
Washing	In the washing stage of the process, wash water rinses both the developer and fixer solutions from the film, which prepares the film for drying. Proper washing of the film ensures a permanent image on the film.
Drying	In the drying stage of the process, the film is dried so that the image can withstand handling.

The PROCESSOR

The *Kodak X-Omat* M43, M43A, and Clinic 1 PROCESSORS are designed to contain 4 sections that correspond with the 4 stages of the film processing:

1. DEVELOPER SECTION
2. FIXER SECTION
3. WASH SECTION
4. DRYER SECTION

Figure 1 **Identifying the Sections of the PROCESSOR**



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Film Entrance

The operator begins to process a sheet of film by placing the film onto the FEED TRAY and feeding the film along the **left edge** of the FEED TRAY. A set of 3 FILM SENSORS detects the film on the FEED TRAY and brings the PROCESSOR out of Standby Mode, which then allows the ENTRANCE ROLLERS to transport the film into the DEVELOPER SECTION of the PROCESSOR.

For optimum replenishment of the processing solutions, feed films along the **left edge** of the FEED TRAY. See the section “Detecting Film” on Page 35 for more information.

DEVELOPER SECTION

Components

The DEVELOPER SECTION contains the following components:

- DEVELOPER RACK, which consists of:
  - Series of GEARS and ROLLERS
  - RACK COVER
  - GUIDE SHOES
  - MANIFOLD BOX
- DEVELOPER TANK, which consists of:
  - 850 watt HEATER
  - THERMISTOR
  - HEAT EXCHANGER
- DEVELOPER RECIRCULATION PUMP
- DEVELOPER REPLENISHMENT PUMP

Process

The developing process consists of a few simple steps.

[1] The film enters the DEVELOPER RACK through the ENTRANCE ROLLERS.

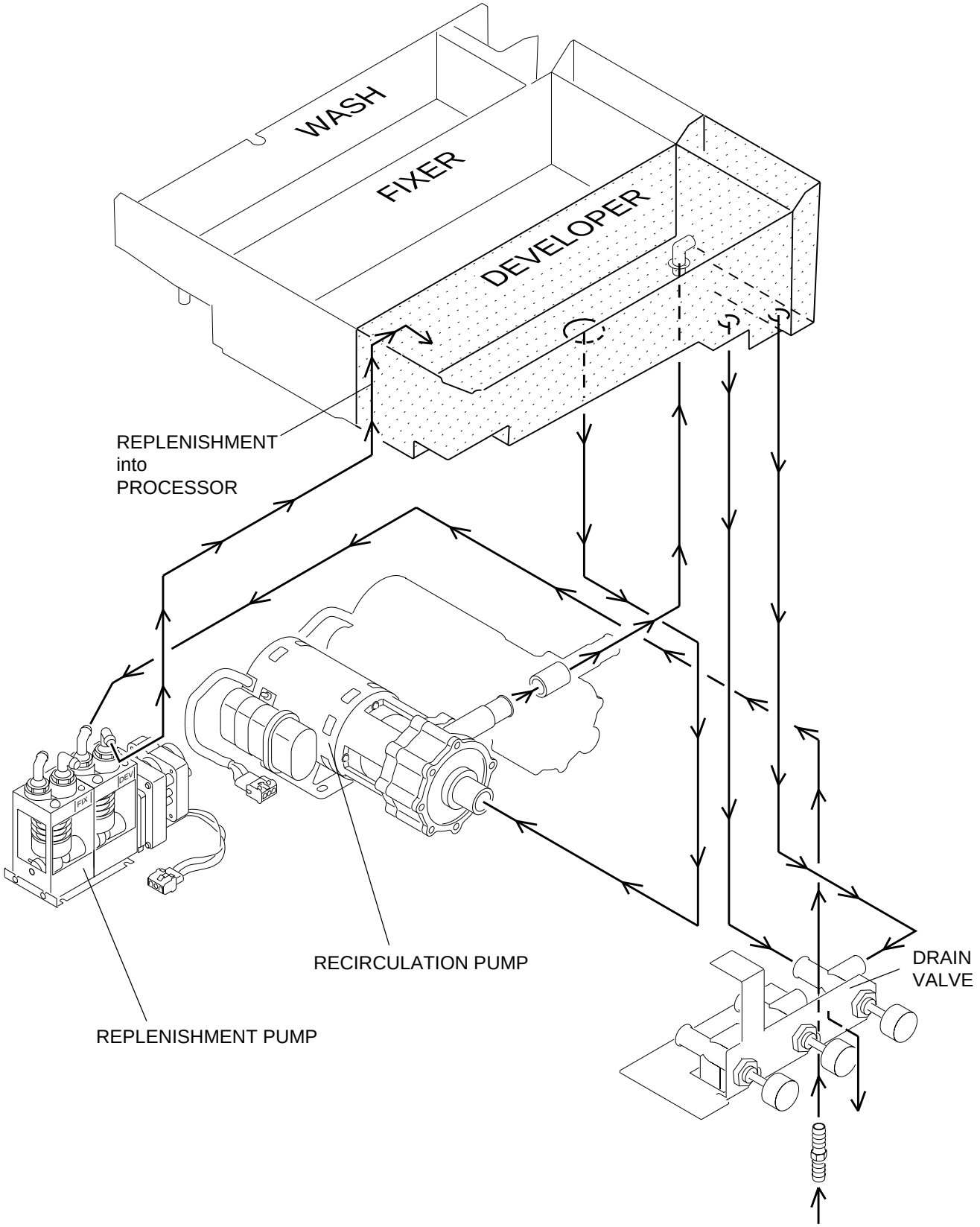
[2] The DEVELOPER RACK immerses the film in the TANK full of developer solution for 17 seconds. The total development time is approximately 28 seconds.

[3] The DEVELOPER RECIRCULATION PUMP continually recirculates the developer solution from the TANK into the RACK. The pumping actions causes the gentle agitation of the developer solution surrounding the film in the DEVELOPER RACK.

[4] The film exits the DEVELOPER RACK and enters into the FIXER SECTION.

[5] The amount of developer replenishment solution that the replenishment system delivers is based on the area of the film fed.

Figure 2 **Solution Flow in the DEVELOPER TANK**



FIXER SECTION

Components

The FIXER SECTION contains the following components:

- FIXER RACK, which consists of:
  - Series of GEARS and ROLLERS
  - GUIDE SHOES
- FIXER TANK, which consists of:
  - HEAT EXCHANGER - (M43 and M43A Models Only)
- FIXER RECIRCULATION PUMP
- FIXER REPLENISHMENT PUMP

Process

The fixing process consists of a few simple steps.

[1] The film enters the FIXER RACK from the DEVELOPER SECTION through a set of ENTRANCE ROLLERS.

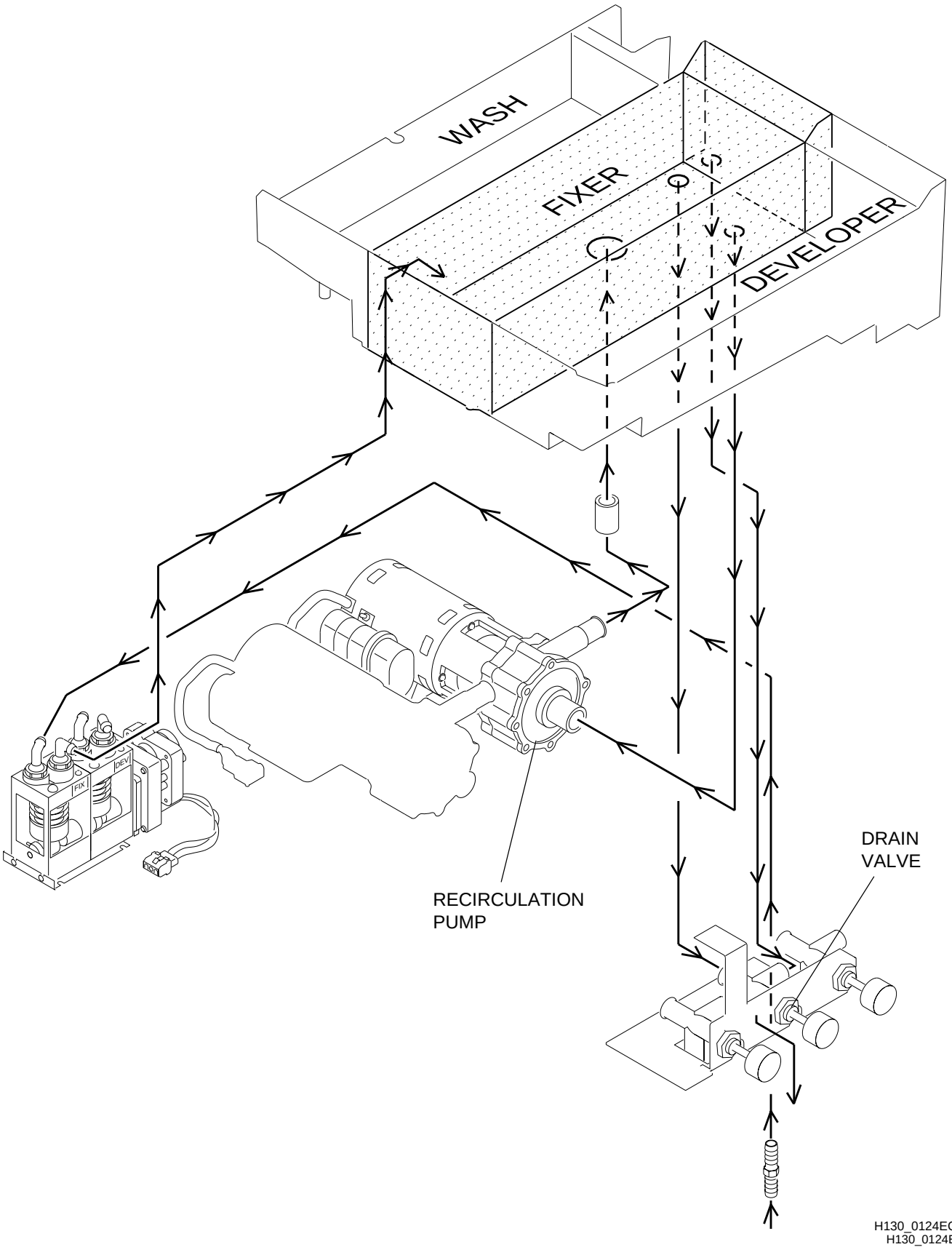
[2] The FIXER RACK immerses the film in the TANK full of fixer solution for 17 seconds.

[3] The FIXER RECIRCULATION PUMP continually recirculates the fixer solution from the TANK into the RACK. The pumping action causes the gentle agitation of the fixer solution surrounding the film in the FIXER RACK.

[4] The film exits the FIXER RACK and enters the WASH SECTION.

[5] The amount of fixer replenishment solution that the replenishment system delivers is based on the area of film fed.

Figure 3 **Solution Flow in the FIXER TANK**



WASH SECTION

Components

The WASH SECTION contains the following components:

- WASH RACK, which consists of:
  - set of ENTRANCE ROLLERS
  - UPPER WASH TUBE
  - LOWER WASH TUBE
  - set of EXIT SQUEEGEE ROLLERS
  - series of GEARS and ROLLERS
  - MANIFOLD
- WATER SOLENOID
- WASH TANK
- WASH PUMP
- DIVERTER VALVE (M43 and M43A Models Only)

Process

The washing process consists of a few simple steps.

[1] The film enters the WASH RACK from the FIXER SECTION through a set of ENTRANCE ROLLERS.

[2] The WASH RECIRCULATION PUMP pumps wash water from the TANK, through the DIVERTER VALVE (M43 and M43A Only), through the MANIFOLD, and into the LOWER and UPPER WASH TUBES.

[3] The WASH TUBES create a fluid suspension layer through which the film passes. This technique allows for superior rinsing of the film without needing to immerse the film into the TANK.

[4] The EXIT SQUEEGEE ROLLERS eliminate any excess water from the film before the film enters the DRYER RACK.

[5] The film exits the WASH RACK and enters setpointthe DRYER SECTION.

The wash stage is critical to the entire process because:

- Washing the film eliminates all residual chemicals and therefore:
  - prevents artifacts on the film
  - prevents the deterioration of the image over time

Figure 4 **Wash Water Flow in the M43 and M43A PROCESSORS**

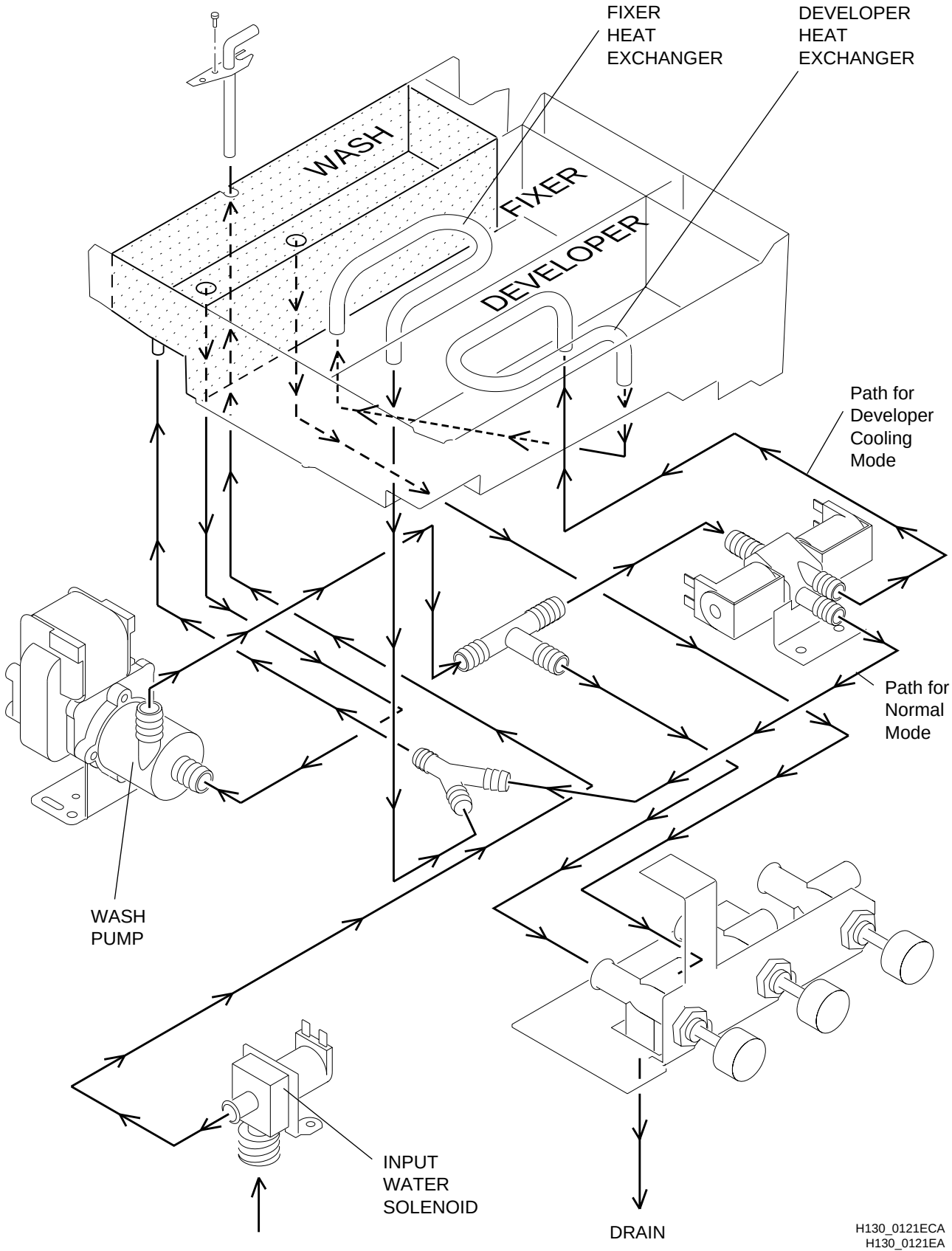
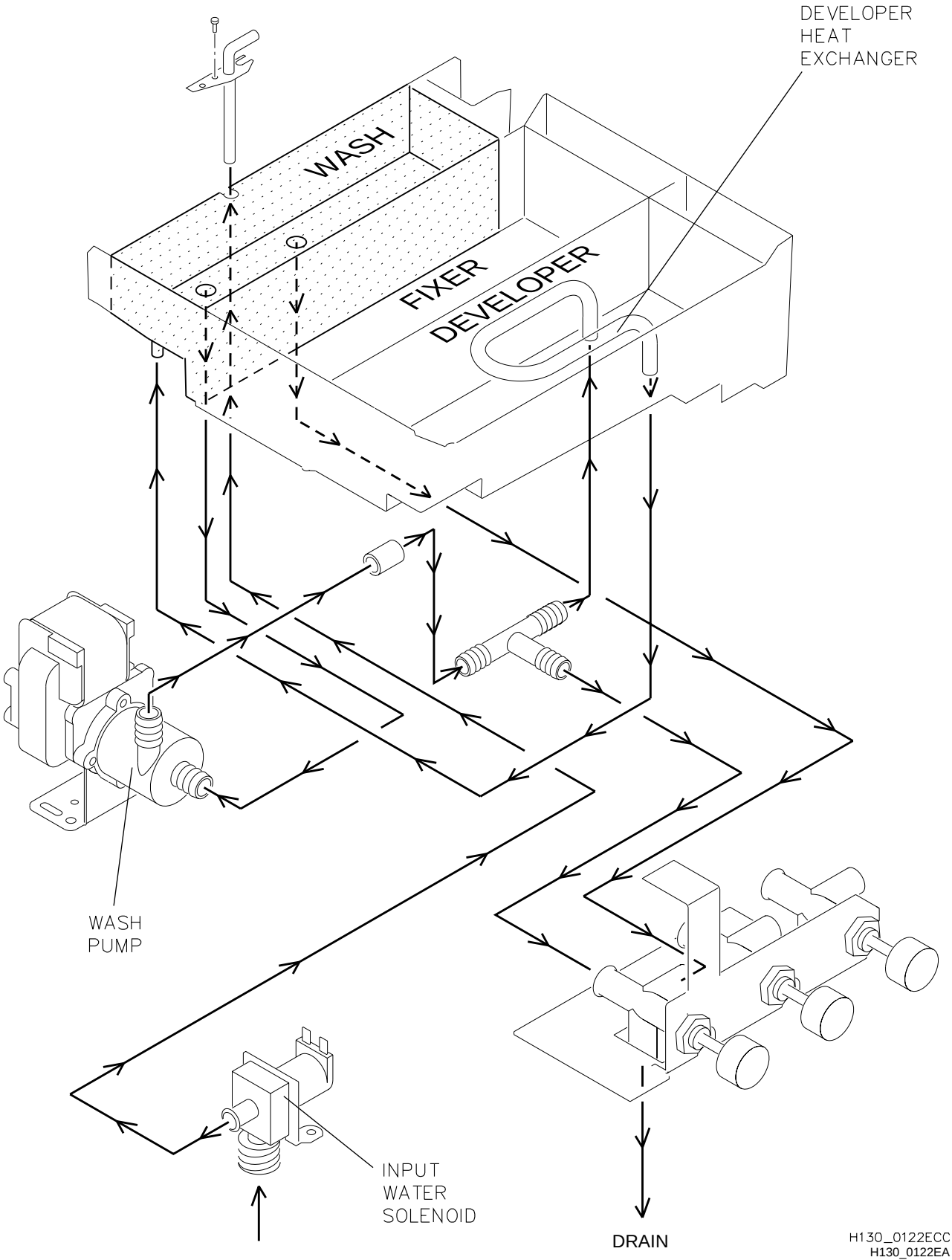


Figure 5 **Wash Water Flow in the Clinic 1 PROCESSOR**



DRYER SECTION

Components

The DRYER SECTION contains the following components:

- DRYER RACK, which includes:
  - AIR TUBES
  - FILM TRANSPORT ROLLERS
- PLENUM, which includes:
  - BAFFLE
  - HEATER
  - AIR VANE SWITCH
  - THERMISTOR
- BLOWER
- TEMPERATURE CONTROL POTENTIOMETER

Process

The drying process consists of a few simple steps.

[1] The film enters the DRYER RACK from the WASH SECTION through a set of ENTRANCE ROLLERS.

[2] The film is transported through the RACK by a series of ROLLERS. AIR TUBES create 2 layers of hot air through which the film passes. The method of drying allows hot air to be circulated across both sides of the film as the film passes through the ROLLERS, and consequently allows for a more efficient dryer system.

[3] The film exits the DRYER RACK and enters into the RECEIVING BIN.

Section 3: Temperature Control

Regulating the Temperature of the Developer Solution

Components

The temperature of the developer solution is regulated by several different components:

- DEVELOPER RECIRCULATION PUMP (B5)
- DEVELOPER THERMISTOR (RT1)
- 100 CIRCUIT BOARD
- WASH RECIRCULATION PUMP (B2)
- SOLID STATE RELAY (U3) controlling DEVELOPER HEATER (HR1)
- SOLID STATE RELAY (U4) controlling WASH RECIRCULATION PUMP (B2)
  - B2 recirculates water through a HEAT EXCHANGER in the DEVELOPER TANK
- DIVERTER VALVE ASSEMBLY (M43 and M43A Models Only)
- INCOMING WATER SOLENOID (L1)
- HEAT EXCHANGER in the DEVELOPER TANK

Process

The components listed above regulate and maintain the temperature of the developer solution to within ± 0.3°C (±0.5°F) of the set-temperature through a series of steps:

Important

The DC INTERLOCK S6 is only found in PROCESSORS that either have a serial number of 350 or higher, or have Mod 1 installed.

[1] The closing of the TOP COVER actuates the 2 INTERLOCK SWITCHES S5 and S6.

[2] CIRCUIT BREAKER (CB1) provides voltage to the DEVELOPER RECIRCULATION PUMP (B2).

[3] While the developer solution is recirculating, the DEVELOPER THERMISTOR (RT1) monitors the temperature of the developer solution.

[4] The resistance of the DEVELOPER THERMISTOR (RT1) changes inversely with the temperature of the developer solution.

[5] The 100 CIRCUIT BOARD reacts to variations in resistance that develop across the DEVELOPER THERMISTOR (RT1) due to a change in temperature of the developer solution.

[6] The PROCESSOR compares the sensed temperature value to the set-temperature value. The PROCESSOR maintains the set-temperature by the following series of steps.

(a) If necessary, the PROCESSOR supplies heat by energizing and de-energizing SSR U3 and the DEVELOPER HEATER (HR1).

(b) If necessary, the PROCESSOR provides cooling by energizing and de-energizing several components:

- SSR U4
- WASH RECIRCULATION PUMP (B2)
- DIVERTER VALVE ASSEMBLY (M43 and M43A Only)
  - L2 DEVELOPER COOLING SOLENOID (M43 and M43A Only)
  - L3 WASH SOLENOID (M43 and M43A Only)
- INCOMING WATER SOLENOID (L1)

The Developer Heating System

Once the DEVELOPER THERMISTOR (RT1) senses a temperature change, the information is transmitted through CONNECTOR P/J104 into the MICROPROCESSOR located on the 100 CIRCUIT BOARD. The MICROPROCESSOR then determines when it needs to actuate the SOLID STATE RELAY (U3). Once actuated, the SOLID STATE RELAY (U3) then applies line voltage to energize the DEVELOPER HEATER (R1). The MICROPROCESSOR uses a proportional control algorithm to determine when to energize the components. The algorithm determines the correct duty cycle for the DEVELOPER HEATER depending on how close the temperature reading is to the setpoint temperature. The table below indicates the relationship between duty cycle and developer temperature.

Table 3 DEVELOPER HEATER Duty Cycles

Duty Cycle	Current Developer Temperature Measured in °Fahrenheit*
100%	> 1.0° below setpoint temperature
75%	<= 1.0°, > 0.7° below setpoint temperature
60%	<= 0.7°, > 0.5° below setpoint temperature
40%	<= 0.5°, > 0.3° below setpoint temperature
20%	<= 0.3°, > 0.2° below setpoint temperature
0%	<= 0.2° below setpoint temperature

* To convert degrees Fahrenheit to degrees Celsius, subtract 32 from the Fahrenheit temperature and divide the resulting temperature by 1.8.

Kodak X-Omat Clinic 1 PROCESSOR Only:

The PROCESSOR energizes the DEVELOPER HEATER 100% to offset the cooling effect of the WASH PUMP only when **both** conditions below exist:

1. The PROCESSOR energizes the WASH PUMP because an operator is feeding film.
2. The developer temperature is below the setpoint temperature.

Developer Temperature Control

Measuring the Temperature of the Developer Solution

Kodak X-Omat M43 and M43A PROCESSORS have a THERMISTOR, which measures the temperature of the developer solution. The PROCESSOR averages 10 THERMISTOR readings in order to minimize the effect of instantaneous changes of temperature at the THERMISTOR. The DEVELOPER TEMPERATURE DISPLAY, located on the FRONT PANEL of the PROCESSOR, displays the temperature obtained from the averaging process, and updates the DISPLAY every 2 seconds.

Controlling the Temperature of the Developer Solution (Heating Only)

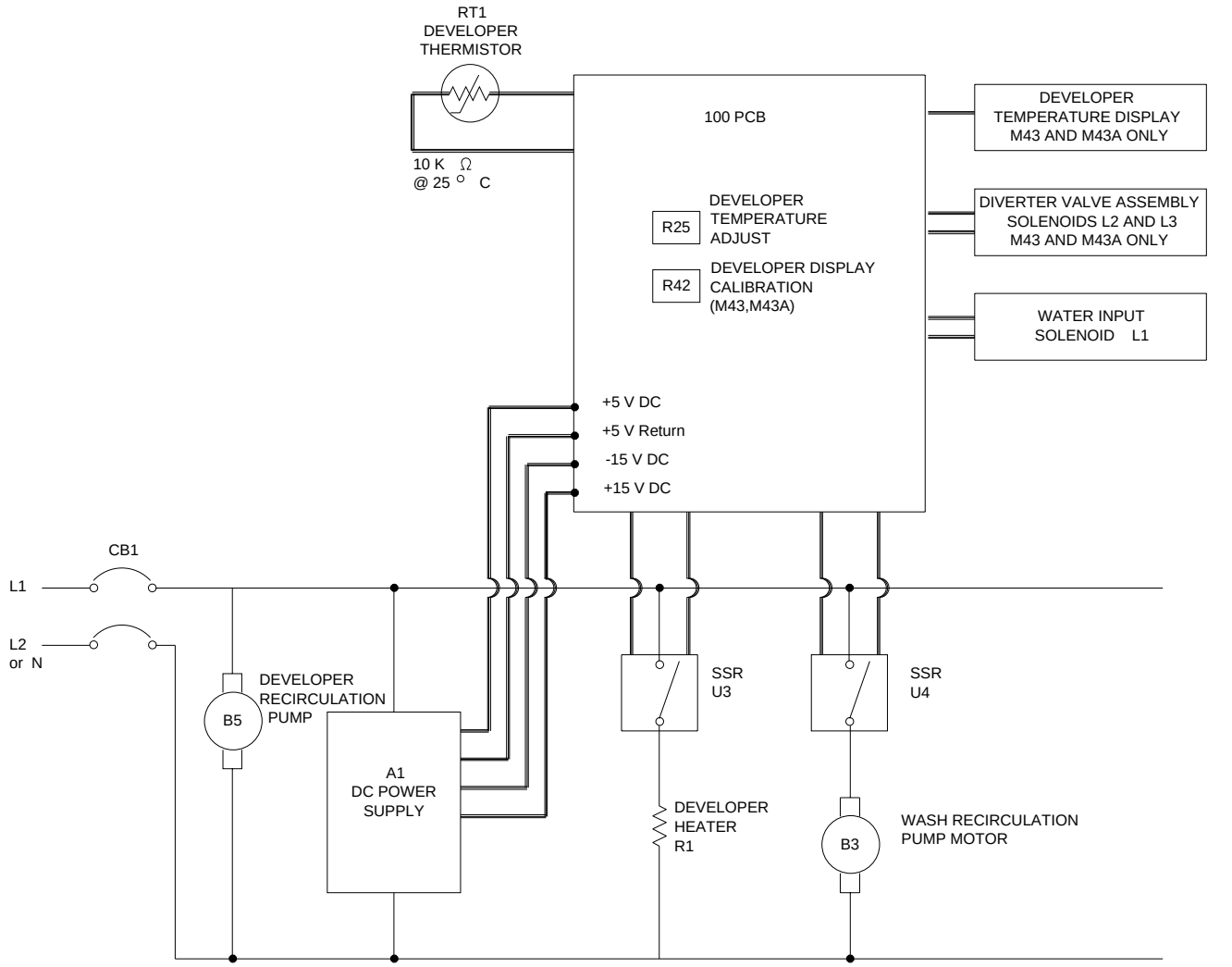
The temperature control subsystem is responsible for maintaining the temperature of the developer solution to within 0.3°C (0.5°F) above or below the setpoint temperature under **all** operating conditions of the PROCESSOR.

The setpoint temperature for the developer solution may be set for any temperature between 32 – 39°C (90 – 102.5°F). **Only a qualified service provider** should set or change the setpoint temperature by rotating POTENTIOMETER (R25) on the 100 CIRCUIT BOARD. Normally, the service person sets up the PROCESSOR to obtain optimum results for use with *Kodak* film and chemicals. The optimum setpoint temperature when using *Kodak* film and chemicals is 33.9°C (93°F).

Calibrating the DEVELOPER TEMPERATURE DISPLAY

The DEVELOPER TEMPERATURE DISPLAY can be calibrated by rotating POTENTIOMETER (R42). **Only a qualified service provider should calibrate the DEVELOPER TEMPERATURE DISPLAY.**

Figure 6 **Control System for Developer Temperature**



DEVELOPER TEMPERATURE CONTROL
M43, M43A AND CLINIC 1 PROCESSORS

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Operation of the Cooling System in the *Kodak X-Omat* Clinic 1 PROCESSOR Only:

During Standard Film Feeding:

Approximately 45 seconds after an operator feeds a sheet of film into the PROCESSOR, the WASH RECIRCULATION PUMP actuates to circulate wash water through the HEAT EXCHANGER in the bottom of the DEVELOPER TANK. Because the wash water is cold, the flow of the water through the HEAT EXCHANGER tends to cool the temperature of the developer solution. If necessary to partially offset the decrease in temperature of the developer solution, the DEVELOPER HEATER may energize. The cold wash water that is circulated through the HEAT EXCHANGER in the DEVELOPER TANK eventually returns to the WASH TANK through the WASH TUBES in the WASH RACK, thus completing the cycle. Because this cooling process takes time to work, you should not feed more than 5 sheets of film consecutively, or else a wait condition may result.

When the Developer Temperature Rises Above the setpoint Temperature:

If the temperature of the developer solution increases and reaches 0.1°C (0.2°F) above the setpoint temperature, the WASH RECIRCULATION PUMP energizes. The WASH RECIRCULATION PUMP circulates wash water from the WASH TANK through the HEAT EXCHANGER in the DEVELOPER TANK and back into the WASH TANK. This action helps to cool the developer solution.

When Additional Cooling is Required From the WATER INPUT SOLENOID in Low Water Usage Mode:

If however, the wash water becomes too warm to provide sufficient cooling for the developer solution, and the temperature of the developer solution reaches 0.15°C (0.3°F) above the setpoint temperature, the WATER INPUT SOLENOID energizes. The WATER INPUT SOLENOID provides cooler incoming water that reduces the temperature of the water in the WASH TANK. The WATER INPUT SOLENOID remains energized and the cooling process continues until the temperature of the developer solution decreases to 0.1°C (0.2°F) above the setpoint temperature. Once the temperature of the developer solution decreases to just 0.1°C (0.2°F) above the setpoint temperature, the WATER INPUT SOLENOID de-energizes, but the WASH PUMP remains energized circulating wash water through the HEAT EXCHANGER until the temperature of the developer solution decreases to setpoint temperature.

In Continuous Water Usage Mode, the WATER INPUT SOLENOID remains energized continuously after warm-up.

Operation of the Cooling System in the *Kodak X-Omat* M43 and M43A PROCESSORS Only:

Because the M43 and M43A PROCESSORS contain a DIVERTER VALVE that the Clinic 1 PROCESSOR does not have, the cooling system of the M43 and M43A PROCESSORS works differently from that of the Clinic 1 PROCESSOR.

During Standard Film Feeding

Approximately 45 seconds after an operator feeds a sheet of film into the PROCESSOR, the WASH RECIRCULATION PUMP actuates to circulate wash water. Up to this point, the M43 and M43A PROCESSORS operate similarly to the Clinic 1 PROCESSOR. In the Clinic 1 PROCESSOR, the WASH RECIRCULATION PUMP pumps the cool wash water into the HEAT EXCHANGER in the DEVELOPER TANK. In the M43 and M43A PROCESSORS, the wash water may or may not be pumped into the HEAT EXCHANGER depending upon the temperature of the developer solution. If the temperature of the developer solution is within the acceptable range, then the DIVERTER VALVE remains closed and the wash water is pumped only through the WASH SECTION of the PROCESSOR. By not pumping the cool wash water through the HEAT EXCHANGER in the DEVELOPER TANK, the PROCESSOR helps to maintain the setpoint temperature of the developer solution.

When the Developer Temperature Rises Above the setpoint Temperature:

If however the temperature of the developer solution reaches 0.1°C (0.2°F) above the setpoint temperature, the PROCESSOR switches the DIVERTER VALVE to its cooling position. In this case, the WASH RECIRCULATION PUMP circulates the cool wash water through the HEAT EXCHANGER in the DEVELOPER TANK and then through the WASH SECTION of the PROCESSOR. The circulation of the cool wash water through the HEAT EXCHANGER in the developer tank thereby helps to cool the developer solution.

When Additional Cooling is Required From the WATER INPUT SOLENOID in Low Water Usage Mode:

If however, the wash water becomes too warm to provide sufficient cooling for the developer solution, and the temperature of the developer solution reaches 0.15°C (0.3°F) above the setpoint temperature, the WATER INPUT SOLENOID energizes. The WATER INPUT SOLENOID provides cooler incoming water that reduces the temperature of the water in the WASH TANK. The WATER INPUT SOLENOID remains energized and the cooling process continues until the temperature of the developer solution decreases to 0.1°C (0.2°F) above the setpoint temperature. Once the temperature of the developer solution decreases to just 0.1°C (0.2°F) above the setpoint temperature, the WATER INPUT SOLENOID de-energizes, but the WASH PUMP remains energized circulating wash water through the HEAT EXCHANGER until the temperature of the developer solution decreases to setpoint temperature.

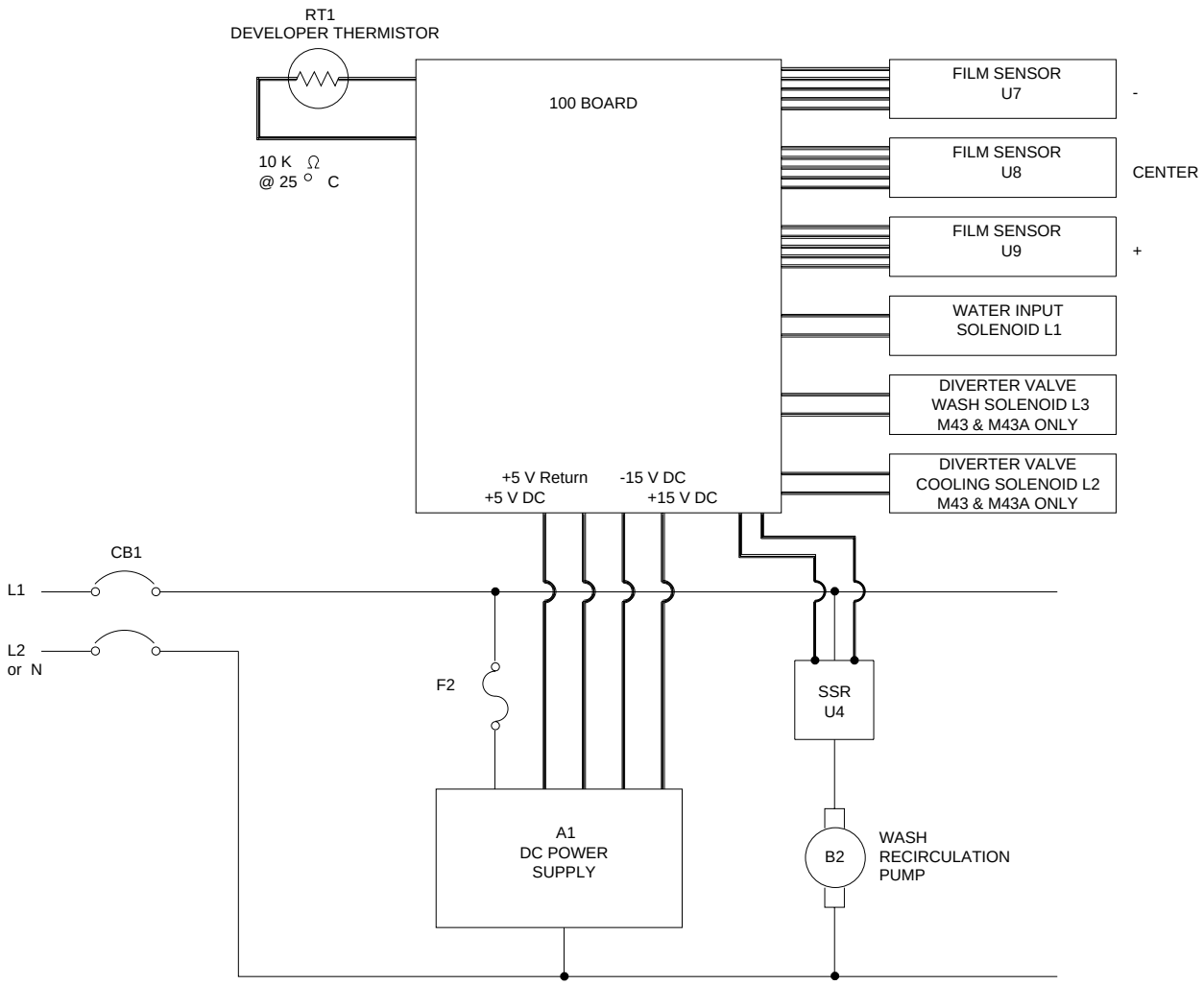
Operation of the Water Usage Mode

The PROCESSOR is factory set for Continuous Water Usage Mode. In this mode, water runs at one litre per minute. This allows fresh water to circulate through the PROCESSOR and prevent biological growth. If biological growth is not a concern, the PROCESSOR may be set to Low Water Usage Mode.

In Continuous Water Usage Mode, the WATER INPUT SOLENOID remains energized continuously after warm-up.

The WASH WATER DRAIN VALVE has an orifice that allows continuous draining of the WASH TANKS.

Figure 7 **Control Systems for Cooling the Developer Solution**



WASH WATER AND DEVELOPER COOLING CONTROL

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Regulating the Temperature of the Fixer Solution

In the *Kodak X-Omat* M43 and M43A PROCESSORS Only:

The M43 and M43A PROCESSORS regulate the temperature of the fixer solution by pumping wash water through the HEAT EXCHANGER in the bottom of the FIXER TANK. The wash water either absorbs or gives off heat depending upon its temperature relative to the temperature of the fixer solution. The transfer of heat between the wash water in the HEAT EXCHANGER and the fixer solution eventually cools or heats the fixer solution.

Unlike the DEVELOPER TANK, the FIXER TANK does not contain a HEATER or a THERMISTOR. Because the temperature of the fixer solution is regulated through heat transfer and not regulated electronically, the HEATER and THERMISTOR are not needed.

In the *Kodak X-Omat* Clinic 1 PROCESSOR Only:

Unlike the M43 and M43A PROCESSORS, the Clinic 1 PROCESSOR does **not** regulate the temperature of the fixer solution. Therefore, the Clinic 1 PROCESSOR does **not** have a HEAT EXCHANGER in the FIXER TANK. The temperature of the fixer solution depends primarily on the internal temperature of the PROCESSOR, which is regulated by the DRYER temperature setting. However, the fixer temperature can also be affected by the ambient temperature and room conditions. If the ambient temperature and humidity are not within the specifications outlined in the Site Specifications, Publication Number 981087, correct “fixing” of the films cannot be ensured.

Regulating the Temperature of the DRYER

Adjusting the setpoint Temperature of the DRYER

The operator can select and adjust the setpoint temperature of the DRYER simply by rotating the DRYER TEMPERATURE CONTROL KNOB located on the front DISPLAY PANEL of the PROCESSOR. By rotating the DRYER TEMPERATURE CONTROL KNOB, the operator is actually rotating the DRYER HEATER POTENTIOMETER (R3). The KNOB provides the operator with 11 detent positions to choose from. The detent positions correspond to the setpoint temperatures outlined in the table below.

Table 4 DRYER setpoint Temperatures for the M43, M43A, and Clinic 1 PROCESSORS

Detent Position	A/D Range	Celsius	Fahrenheit
0	0 - 11	32°	90°
1	12 - 37	34.4°	94°
2	38 - 63	36.7°	98°
3	64 - 88	38.9°	102°
4	89 - 113	41.4°	106°
5	114 - 139	43.1°	110°
6	140 - 165	45.6°	114°
7	166 - 191	48.0°	118°
8	192 - 216	50.0°	122°
9	217 - 242	52.2°	126°
10	243 - 255	54.2°	130°

Once the operator has selected a setpoint temperature for the DRYER, the DRYER temperature control subsystem is responsible for maintaining the temperature of the DRYER to within approximately 4°C (7°F) above or below the setpoint temperature.

Components

The DRYER temperature control subsystem includes several components:

- DRYER THERMISTOR (RT2)
- 100 CIRCUIT BOARD
- SOLID STATE RELAY (U6) controlling DRYER BLOWER (B1) and DRIVE MOTOR (B4)
- DRYER AIR VANE SWITCH (S4)
- DRYER HEATER POTENTIOMETER (R3)
- SOLID STATE RELAY (U1) controlling DRYER HEATER (HR2)

Process

The components listed regulate and maintain the temperature of the DRYER through a series of steps:

[1] The 100 CIRCUIT BOARD senses air temperature changes in the DRYER when resistance variations develop across DRYER THERMISTOR (RT2) due to temperature changes in the DRYER.

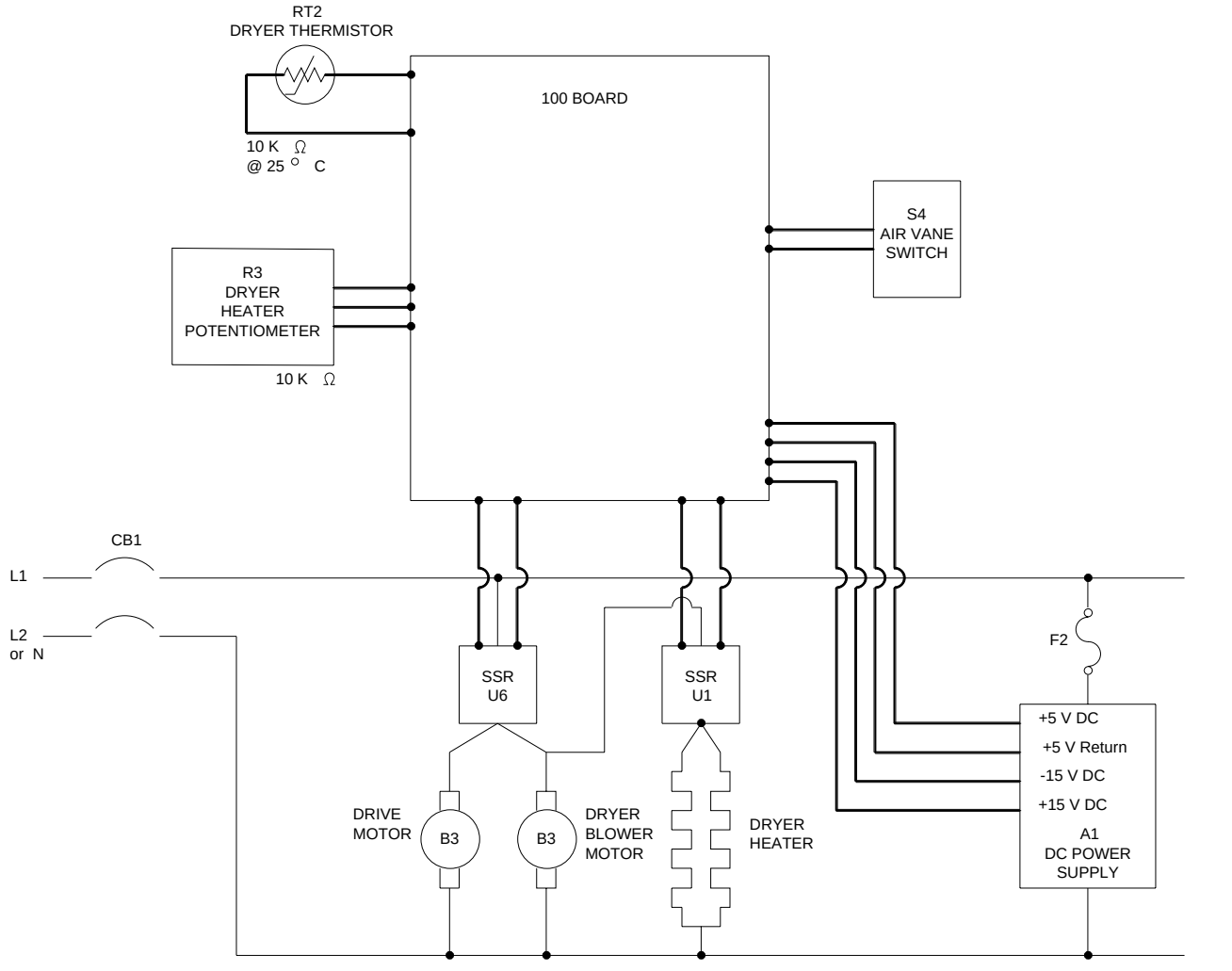
[2] RT2 varies inversely (decreasing in resistance) as DRYER air temperature increases.

[3] The 100 BOARD compares the DRYER setpoint temperature (R3) to the actual temperature (RT2) of the air in the PLENUM.

[4] The 100 BOARD energizes SOLID STATE RELAY (U1) to control power and duty cycle to DRYER HEATER (HR2).

[5] DRYER AIR VANE SWITCH (S4) monitors the BLOWER status and informs the 100 BOARD when it is safe to apply power to DRYER HEATER (HR2).

Figure 8 **DRYER Circuit for the M43A and Clinic 1 PROCESSORS**
In M43 PROCESSORS, the HEATER COILS are Wired in Series



DRYER Operation During PROCESSOR Start-Up

When the PROCESSOR is first energized, the DRYER HEATER energizes to 100% of its capacity until the temperature of the DRYER reaches 4°C (7°F) above the setpoint temperature. If the temperature of the DRYER has not reached at least 3°C (5°F) below the setpoint temperature within 45 minutes after the operator energized or reset the PROCESSOR, the PROCESSOR indicates an error condition. The PROCESSOR may display either a DRYER Under Range Error (E10) or a DRYER Under Temperature Warning (E13), depending upon how far the DRYER temperature is below the setpoint temperature.

DRYER Operation During the Processing of Films

Located in the DRYER SECTION of the PROCESSOR, is a DRYER HEATER. The 100 CIRCUIT BOARD controls the DRYER HEATER by sending an actuation command to SSR U1. SSR U1 then controls the current necessary to energize the DRYER HEATER.

The PROCESSOR energizes the DRYER HEATER to **100% of its capacity** in 2 operating conditions:

1. The temperature of the DRYER is more than 2.3°C (4°F) below the setpoint temperature, and the DRYER TEMPERATURE CONTROL KNOB is set between 1 and 8.
2. The DRYER TEMPERATURE CONTROL KNOB is set at 9 or 10.

The DRYER HEATER **remains energized at 100% of its capacity** until one of the following conditions exists:

1. The temperature of the DRYER reaches 4°C (7°F) above the setpoint temperature with the DRYER TEMPERATURE CONTROL KNOB set between 1 and 8.
2. The 2 Minute Film Clear TIMER expires and the DRYER TEMPERATURE CONTROL KNOB is set at 9 or 10.
3. The temperature of the DRYER reaches 66°C (150°F).
4. The temperature of the developer reaches more than 3°C (5°F) above the setpoint temperature.

The DRYER HEATER energizes again if, during normal operation, the temperature of the DRYER falls to between 2.3 and 4°C (4 and 7°F) below the setpoint temperature. The DRYER HEATER remains energized until the temperature of the DRYER is again within 2.3°C (4°F) of the setpoint temperature.

The PROCESSOR energizes the DRYER HEATER to **only 60% of its capacity** if the temperature of the DRYER reaches 4°C (7°F) above the setpoint temperature and the DRYER TEMPERATURE CONTROL KNOB is set between 1 and 8.

Explanation of Flowchart for DRYER Operation During the Feeding of Film

[1] The MICROPROCESSOR energizes the DRYER BLOWER.

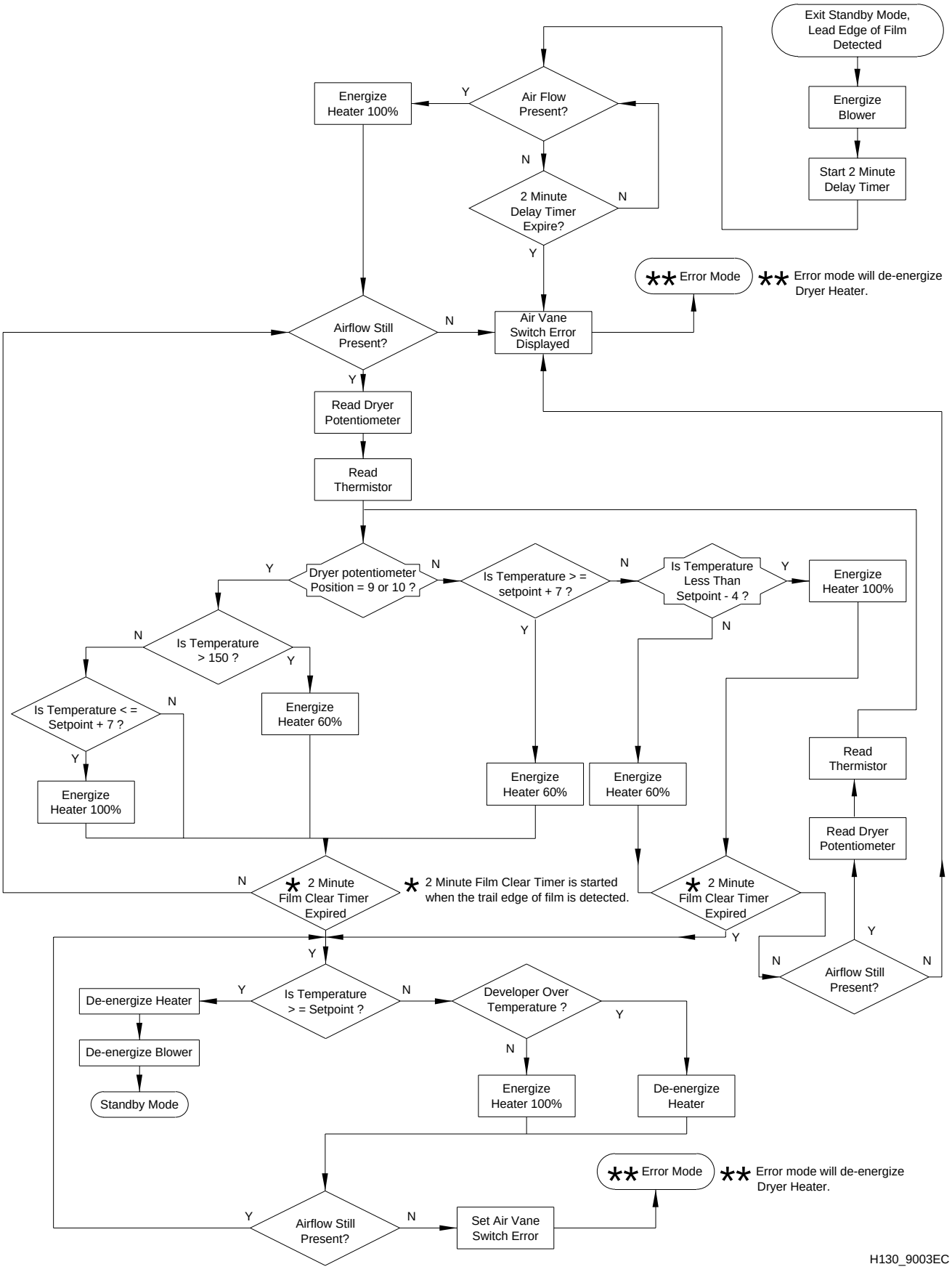
[2] The MICROPROCESSOR sets a 2-minute DELAY TIMER and checks the status of the AIR VANE SWITCH.

(a) If the AIR VANE SWITCH is open and the 2-minute DELAY TIMER has expired, then Error 03 - Air Vane Switch Error is displayed on the DISPLAY PANEL.

(b) If the AIR VANE SWITCH is closed, then the MICROPROCESSOR completes the following actions:

- energizes the DRYER HEATER
- checks the status of the AIR VANE SWITCH
- reads the DRYER HEATER POTENTIOMETER (R3) to determine the setpoint temperature of the DRYER
- reads the THERMISTOR to determine the actual temperature of the DRYER
- The DRYER at this point, operates normally at 100% of its capacity until the temperature of the DRYER reaches 4°C (7°F) above the setpoint temperature.
- If the 2-minute FILM CLEAR TIMER has expired and the temperature of the DRYER has increased to 4°C (7°F) above the setpoint temperature, provided that no film has been sensed, then the MICROPROCESSOR completes the following actions:
  - de-energizes the DRYER HEATER
  - de-energizes the DRYER BLOWER
  - sets the 5-minute STANDBY TIMER

Figure 9 **DRYER Control Flowchart for PROCESSOR During the Processing of Films**



DRYER Operation While the PROCESSOR is in Standby Mode

Both the DRYER HEATER and DRYER BLOWER energize on and off while the PROCESSOR is in Standby Mode. The DRYER HEATER and DRYER BLOWER remain "off" for 5 minutes. However the length of time that the DRYER HEATER and DRYER BLOWER remain "on" may change. The components can remain "on" anywhere from 30 seconds to as long as is required for the DRYER to reach 4°C (7°F) above the setpoint temperature. For example, if the input voltage to the PROCESSOR is low, the "ON" cycles may become longer.

DRYER Temperature Control Algorithm to Assist With the Cooling of the Developer Solution

When the temperature of the developer solution reaches 0.3°C (0.5°F) over the setpoint temperature, the DRYER BLOWER energizes to help remove hot air and draw in cooler air in order to assist with the cooling of the developer solution. The DRYER BLOWER remains energized until the temperature of the developer is within 0.1°C (0.2°F) of its setpoint temperature. Once the developer is within 0.1°C (0.2°F) of its setpoint temperature, the DRYER HEATER energizes and remains energized until the temperature of the DRYER reaches the setpoint temperature. Once the DRYER is at setpoint, the entire DRYER system enters the Standby Mode.

DRYER Operation During the Cooling of the Developer Solution

The DRYER HEATER de-energizes, and the DRYER BLOWER remains energized in order to vent hot air, thereby helping to cool the developer solution when the following conditions exist:

- the FILM SENSORS do not detect film
- the temperature of the developer solution is more than 0.3°C (0.5°F) above the developer setpoint temperature and Service Error 08 - Developer Over Temperature Range is displayed on the DISPLAY PANEL of the PROCESSOR

If the conditions listed above exist, then the DRYER system initiates the following actions:

- the DRYER HEATER is de-energized if it is currently energized
- the DRYER HEATER remains de-energized until the temperature of the developer solution is 0.1°C (0.2°F) above the developer setpoint temperature
- the DRYER HEATER is then energized until the air temperature in the DRYER reaches the setpoint temperature
  - at this point, the DRYER enters Standby Mode

Explanation of Flowchart for DRYER Operation During Standby Mode

Every 5 minutes the PROCESSOR completes the standby cycle and exits Standby Mode for a minimum of 30 seconds. The MICROPROCESSOR first checks the status of the AIR VANE SWITCH.

[1] If the AIR VANE SWITCH is closed, the MICROPROCESSOR displays Error 03 - Air Vane Switch Error on the DISPLAY PANEL of the PROCESSOR.

[2] If the AIR VANE SWITCH is open, the MICROPROCESSOR completes the following actions:

- energizes the DRYER BLOWER
- starts the 2-minute DELAY TIMER
- checks the status of the AIR VANE SWITCH continually until air flow is detected

(a) If the 2-minute DELAY TIMER has expired and no air flow has been detected, the MICROPROCESSOR displays Service Error 02 - Loss of Air Flow Error on the DISPLAY PANEL of the PROCESSOR.

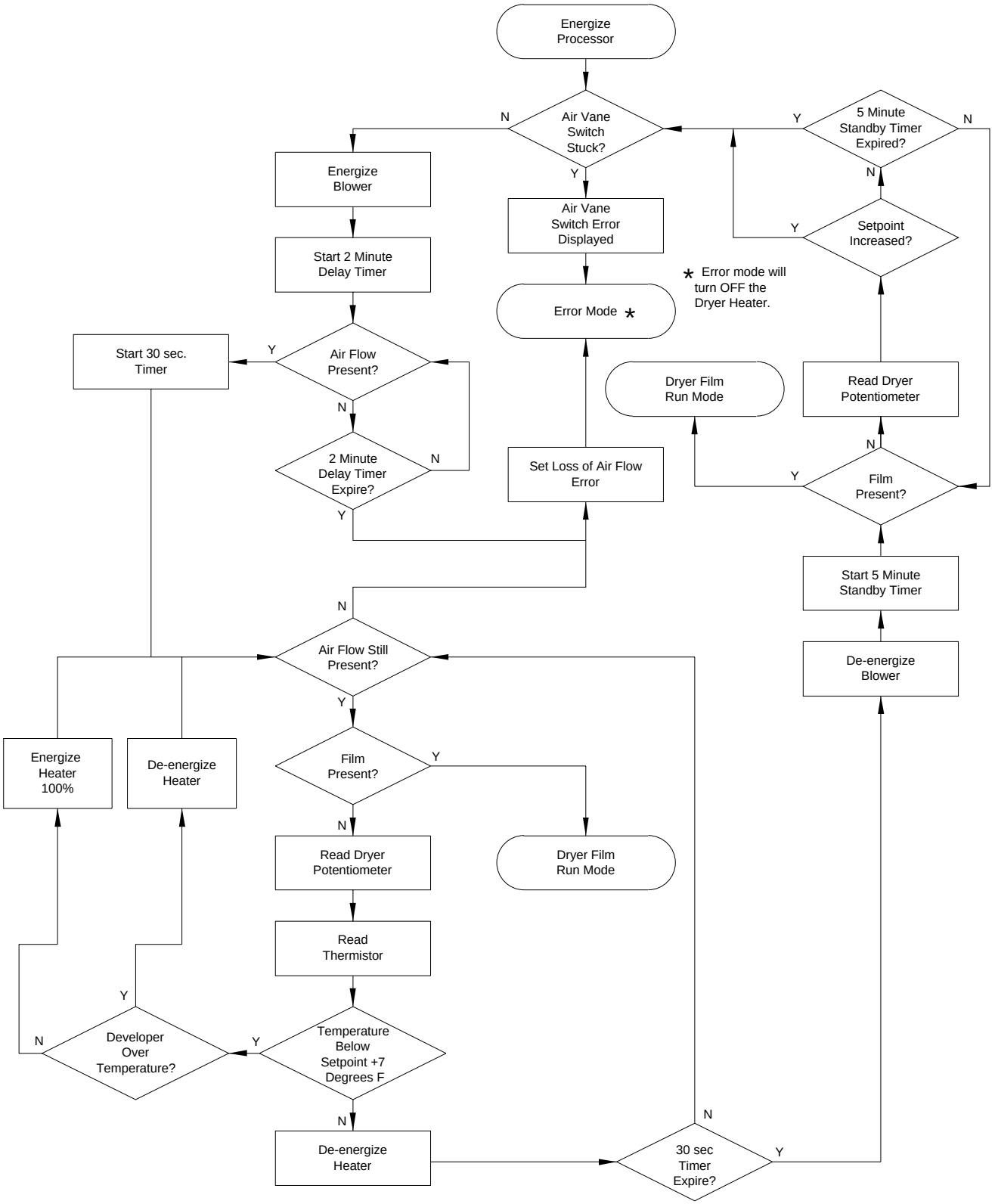
(b) If air flow is detected, the MICROPROCESSOR starts a 30-second TIMER and completes the following actions repeatedly for as long as air flow is detected:

- checks for the presence of film
- reads the DRYER HEATER POTENTIOMETER (R3) to determine the setpoint temperature of the DRYER
- reads the THERMISTOR to determine the actual temperature of the DRYER
- checks whether the temperature of the DRYER is more than 4°C (7°F) above the setpoint temperature

If the DRYER temperature is less than 4°C (7°F) above setpoint, the MICROPROCESSOR checks whether the temperature of the developer solution is over the setpoint temperature.

- If the developer is over temperature, the DRYER HEATER de-energizes but the DRYER BLOWER remains energized to assist with the cooling of the developer solution.
- If the developer is not over temperature, the DRYER HEATER energizes to 100% of its capacity until the temperature of the DRYER reaches 4°C (7°F) above the setpoint temperature.
- Once the DRYER temperature reaches 4°C (7°F) above setpoint, the MICROPROCESSOR completes the following actions:
  - de-energizes the DRYER HEATER
  - de-energizes the DRYER BLOWER, provided that the 30-second TIMER has expired
  - starts the 5 minute Standby TIMER, provided that the 30-second TIMER has expired
- If the operator feeds film during this cycle, the PROCESSOR exits the Standby Mode and enters the Film Run Mode.
- If the operator increases the setting of the DRYER TEMPERATURE CONTROL KNOB, the PROCESSOR exits the Standby Mode in order to increase the DRYER temperature and cycles through the steps outlined above.

Figure 10 **DRYER Control Flowchart for PROCESSOR When Cycling Through Standby Mode**



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Section 4: Control Systems

AC and DC INTERLOCK SWITCHES

Note

The DC INTERLOCK SWITCH S6 is only found in PROCESSORS that either have a serial number of 350 or higher, or have Mod 1 installed. PROCESSORS having a serial number below 350 or without Mod 1 installed have a single SWITCH that incorporates both the AC and DC interlocks.

The INTERLOCK SWITCH(ES) serve(s) as safety feature(s) for the operator. The INTERLOCK SWITCH(ES) prevent(s) the PROCESSOR from operating **without** the TOP COVER installed. Therefore, the operator cannot feed films without the TOP COVER installed. Having the TOP COVER installed when the operator feeds films protects the operator from possible harm from contact with moving parts.

The AC INTERLOCK SWITCH S5 is located on the drive side of the PROCESSOR near the DRYER SECTION. The DC INTERLOCK SWITCH S6 is located on the non-drive side of the DRYER PLENUM and is actuated by a MAGNET inside the TOP COVER.

MAIN CIRCUIT BREAKER CB1

The MAIN CIRCUIT BREAKER CB1 is located on the DISPLAY PANEL on the front of the PROCESSOR. Moving the MAIN CIRCUIT BREAKER CB1 to the “ON” position, allows you to energize the PROCESSOR. The PROCESSOR contains a built-in safety feature that will not allow the PROCESSOR to energize if the TOP COVER is not installed correctly onto the PROCESSOR.

Once you actuate the MAIN CIRCUIT BREAKER CB1, each separate system of the PROCESSOR energizes.

- The DRIVE MOTOR rotates the MAIN DRIVE SHAFT and the DRIVE ROLLERS.
- The DEVELOPER and FIXER RECIRCULATION PUMPS recirculate the processing solutions in the DEVELOPER and FIXER TANKS.
- the DC POWER SUPPLY (A1) and the low voltage TRANSFORMER (T1) provide power to the 100 CIRCUIT BOARD.

100 CIRCUIT BOARD

The 100 CIRCUIT BOARD contains a MICROPROCESSOR, which monitors and controls the PROCESSOR as shown.

Table 5 Monitor and Control Functions of the MICROPROCESSOR

Components Monitored	Components Controlled
SENSORS	STATUS INDICATORS
SWITCHES	SOLID STATE RELAYS

System Initialization

The software initialization procedure occurs any time you:

- energize the PROCESSOR
- reset the PROCESSOR by:
  - placing the TOP COVER on the PROCESSOR
  - exiting from the Diagnostic Mode

The PROCESSOR performs the initialization routine using limited hardware on the 100 CIRCUIT BOARD. The hardware completes the following basic self-checks on the 100 CIRCUIT BOARD to ensure that the MICROPROCESSOR can execute its resident programs.

- RAM test
- PROM checksum test
- I/O PORT check

Sequence of Events after the Completion of the Initialization Routine

Once the 100 CIRCUIT BOARD completes these self-checks successfully, the PROCESSOR performs the actions listed below:

- beeps 3 times
- energizes the WATER INPUT SOLENOID to fill the WASH TANK
- illuminates the WAIT INDICATOR
- checks the AIR VANE SWITCH for the absence of air flow
  - if it detects air flow, it indicates an air flow error
  - if it does not detect air flow, it energizes the DRYER BLOWER and DRIVE MOTOR
- checks the AIR VANE SWITCH again, for the presence of air flow
- energizes the DRYER HEATER and the BLOWER to achieve the correct operating conditions
- energizes the DEVELOPER HEATER
- energizes the DEVELOPER RECIRCULATION PUMP
- energizes the FIXER RECIRCULATION PUMP
- energizes the WASH RECIRCULATION PUMP

Note

If the operator energizes the PROCESSOR without the TOP COVER installed, the PROCESSOR beeps 3 times and enters Replenishment Calibration Mode.

Standby Mode

The PROCESSOR enters the Standby Mode when either of the following conditions exists:

1. the temperature of the DRYER reaches 2.5°C (7°F) above its setpoint temperature
2. approximately 2 minutes after the FILM SENSORS detect the trailing edge of a sheet of film on the FEED TRAY **unless** the operator feeds a second sheet of film

While in the Standby Mode, the PROCESSOR de-energizes certain components or operates them intermittently in order to conserve energy and wear on parts:

- de-energizes the WASH RECIRCULATION PUMP, unless the PUMP is needed for cooling
- maintains developer temperature at its setpoint temperature
- de-energizes the DRYER HEATER, DRYER BLOWER and the MAIN DRIVE MOTOR
  - every 5 minutes, the PROCESSOR energizes the DRYER BLOWER, DRYER HEATER and MAIN DRIVE MOTOR for a minimum of 30 seconds or until the temperature of the DRYER reaches 2.5°C (7°F) above its setpoint temperature

The PROCESSOR, even though in Standby Mode, must occasionally energize the WASH RECIRCULATION PUMP and the WATER INPUT SOLENOID (L1) to cool the developer solution (intermittently) if the temperature of the developer solution is 0.1°C (0.2°F) above the setpoint temperature.

Once the FILM SENSORS detect a film on the FEED TRAY, the PROCESSOR automatically exits the Standby Mode and begins processing films.

Continuous Mode

A qualified service provider can configure the PROCESSOR to operate in the Continuous Mode. The Continuous Mode feature can be selected to help eliminate ROLLER artifacts from appearing on films. The Continuous Mode should be selected for sites with extreme ambient and operating conditions. See the Site Specifications, Publication Number 981087, for the recommended ambient conditions. The Continuous Mode can also be selected when diagnosing errors with the PROCESSOR. All components of the MAIN DRIVE, FILM TRANSPORT, and DRYER systems remain energized continuously for as long as the PROCESSOR is in the Continuous Mode.

MAIN DRIVE SYSTEM

Overview

Once the FILM SENSORS detect film, the PROCESSOR exits the Standby Mode and enters the Operating Mode. When the PROCESSOR enters the Operating Mode, the MAIN DRIVE system energizes and is able to transport film. If you operate the PROCESSOR in the Continuous Mode, the MAIN DRIVE system and all other systems remain operational at all times. Continuous operation of the PROCESSOR can lead to wear on all the parts.

Sequence of Events for the Operating Mode

[1] When the PROCESSOR enters the Operating Mode, a series of actions occurs:

(a) The MAIN DRIVE MOTOR (B4) activates.

(b) The DRYER BLOWER (B1) activates.

(c) The DRYER HEATER (HR2) energizes.

(d) The WASH RECIRCULATION PUMP (B2) energizes, providing water to the WASH RACK.

[2] While the PROCESSOR is in the Operating Mode, the following series of actions occurs:

(a) The MAIN DRIVE MOTOR (B4) provides rotational energy for the DRIVE system, which is used to transport film.

Note

The MAIN DRIVE MOTOR for the M43A and Clinic 1 PROCESSORS is a 115 V AC 50/60 Hz MOTOR. The MAIN DRIVE MOTOR for the M43 PROCESSOR is a 230 V AC 50/60 Hz motor. The MAIN DRIVE MOTOR has an internal GEAR reduction unit to decrease its RPM range (250 RPM on 50 hertz power and 300 RPM range at 60 hertz). An additional SPROCKET equalizes SHAFT rotation so that the MOTOR transports the film at 1.016 cm/sec (0.4 in./sec). In 1 minute the film travels 60.96 cm (24 in.).

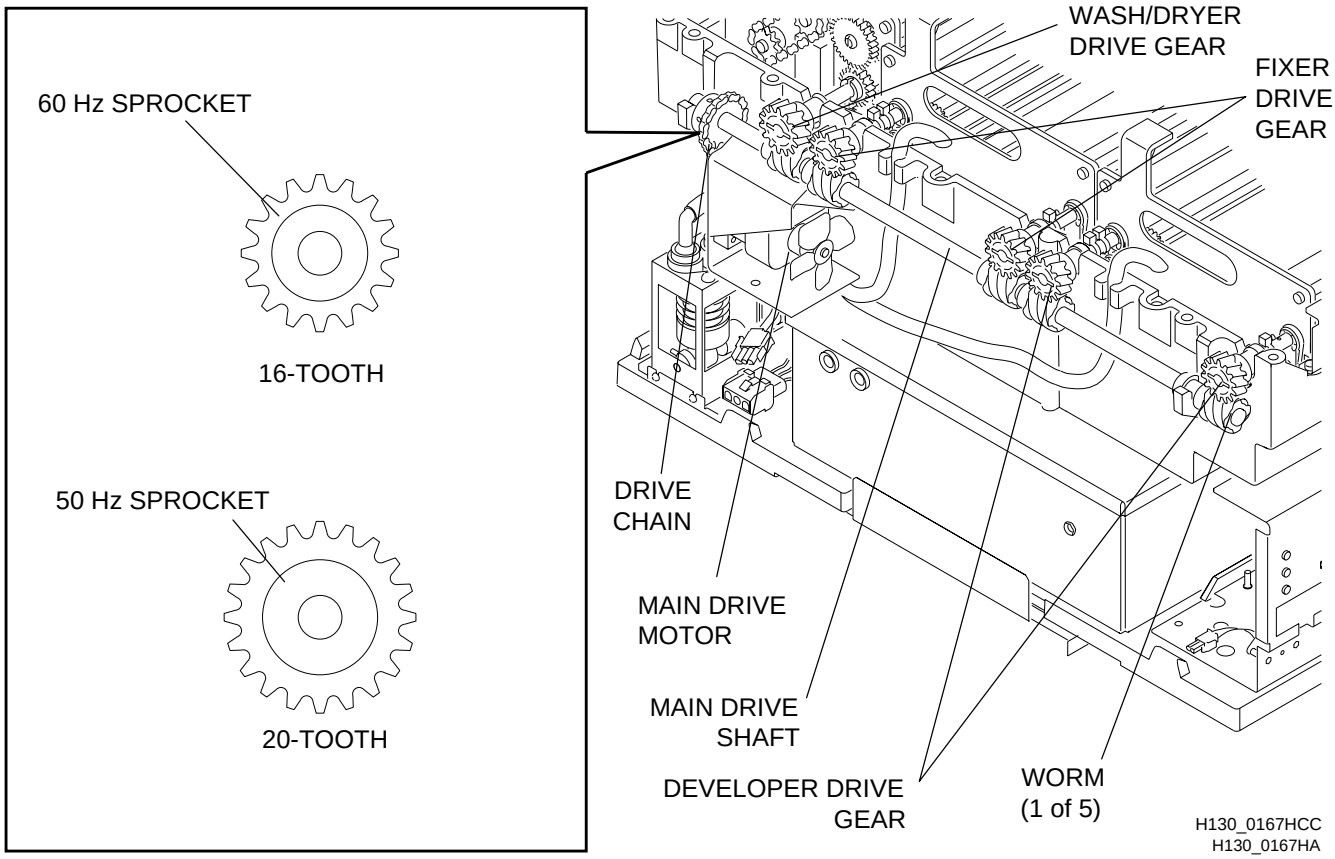
(b) The MAIN DRIVE MOTOR rotates the MAIN DRIVE SHAFT with a DRIVE CHAIN.

(c) A series of WORMS located on the MAIN DRIVE SHAFT drives the DRIVE ROLLERS in the DEVELOPER RACK, FIXER RACK, and WASH RACK.

(d) A GEAR on the DRIVE ROLLER of the WASH RACK drives the ROLLERS in the DRYER RACK.

(e) The PROCESSOR automatically de-energizes the MAIN DRIVE MOTOR while the PROCESSOR is in the Standby Mode.

Figure 11 **The MAIN DRIVE System**



Detecting Film

Overview

The operator should feed a sheet of film along the recommended **left edge** of the FEED TRAY and into the set of ENTRANCE ROLLERS. The M43 and M43A PROCESSORS use 3 FILM SENSORS to determine the area of the sheet of film being fed. The Clinic 1 PROCESSOR uses the same 3 FILM SENSORS, but in the Clinic 1 PROCESSOR the FILM SENSORS determine the length of the film, not the area of the film. The FILM SENSORS must approximate the film area or length in order to determine the amount of replenishment solution needed to maintain sensitometric control. The FILM SENSORS use LIGHT EMITTING DIODE (LED) technology to emit infrared (IR) light energy. The FILM SENSORS pulse the IR light they produce to prevent film exposure. The FILM SENSORS detect the leading edge of a sheet of film when the film reflects the IR light to a light sensitive receptor built into the SENSOR. The FILM SENSORS detect the trailing edge of the film when the film no longer reflects the IR light.

The 3 FILM SENSORS are in 3 different locations on the FEED TRAY:

(RIGHT) FILM SENSOR (U7) - 10.8 cm (4.3 in.) from the left edge of the FEED TRAY

(MIDDLE) FILM SENSOR (U8) - 26.0 cm (10.3 in.) from the left edge of the FEED TRAY

(LEFT) FILM SENSOR (U9) - 40.0 cm (15.8 in.) from the left edge of the FEED TRAY

Note

If the FILM SENSORS detect a film longer than 1.5 m (5 ft), the PROCESSOR indicates an error condition.

Film Approximation for the *Kodak X-Omat* Clinic 1 PROCESSOR Only:

The *Kodak X-Omat* Clinic 1 PROCESSOR detects **only** the **length** of film an operator feeds into the PROCESSOR. The software **always** assumes the width of the film is 43.2 cm (17 in.) when the PROCESSOR calculates replenishment volumes.

For example, the PROCESSOR calculates the area for a 28 x 35 cm (11 x 14 in.) film fed 35 cm (14 in.) wide to be 1204 cm^2 (187 sq in.).

Film Approximation for the *Kodak X-Omat* M43 and M43A PROCESSORS Only:

The *Kodak X-Omat* M43 and M43A PROCESSORS detect the actual length of the film the operator feeds and approximates the width by the use of the 3 FILM SENSORS. See the table below for the estimated dimensions that the PROCESSOR uses in calculating film area.

Table 6 Film Area Approximations for the M43 and M43A PROCESSORS

SENSOR 1 Blocked	SENSOR 2 Blocked	SENSOR 3 Blocked	Estimated Film Width
Yes	No	No	26 cm (10.25 in.)
No	Yes	No	29.2 cm (11.5 in.)
No	No	Yes	17.1 cm (6.75 in.)
Yes	Yes	No	40 cm (15.75 in.)
No	Yes	Yes	32.4 cm (12.8 in.)
Yes	Yes	Yes	43 cm (17 in.)
Yes	No	Yes	43 cm (17 in.)

Replenishment of the Developer and Fixer Processing Solutions

Overview

Note

For information about the recommended replenishment rates of the processing solutions, see either Publication Number 1C0578 located in the pocket of your publications binder or Service Bulletin No. 30.

When the developer and fixer solutions process films, the active chemicals in the solutions react and eventually lose potency. The PROCESSOR supplies the DEVELOPER and FIXER TANKS with a preset amount of developer and fixer solutions as determined by either the area of film processed, or by time if the PROCESSOR is set for the Flooded Replenishment Mode. By replenishing the solutions, the PROCESSOR maintains an effective level of chemical activity in the solutions. The volume of developer and fixer solution to be delivered during replenishment is set at the factory. However, the operator can alter the volumes added by doing the procedure in the section “Replenishment Check Mode” on Page 40..

Replenishment Modes

The PROCESSOR can operate in either of 2 Replenishment Modes:

- Flooded Replenishment Mode
- Normal Replenishment Mode

The PROCESSOR is most commonly operated in the Normal Replenishment Mode. The Normal Replenishment Mode will accommodate most installation sites and operating conditions. However, the Flooded Replenishment Mode will ensure stable processing solutions in sites processing less than 20 sheets of 35 x 43 cm (14 x 17 in.) films per 8 hours.

Flooded Replenishment

If the operator configures the PROCESSOR for the Flooded Replenishment Mode, the PROCESSOR adds a volume of solution equal to the replenishment volume required for 238 sq in. of film every 24 minutes. This maintains the freshness and activity of the processing solutions, even if the operator feeds no additional films. This rate of replenishment is equivalent to processing 20 sheets of 35 x 43 cm (14 x 17 in.) films in an 8-hour period. The PROCESSOR also adds replenishment water whenever an operator feeds a sheet of film.

A qualified service provider can configure your PROCESSOR to operate in the Flooded Replenishment Mode by moving the position of JUMPER (E1) on the 100 CIRCUIT BOARD.

Normal Replenishment

The replenishment control subsystem supplies developer and fixer solution to the DEVELOPER and FIXER PROCESSING TANKS any time the REPLENISHMENT PUMPS energize. The subsystem delivers a volume of processing solutions based on the approximate film area determined by the 3 FILM SENSORS. The PROCESSOR calculates film area using the following formula:

$$\text{Replenishment volume for film} = \frac{\text{area of current film}}{\text{238 sq in.}} \times (\text{volume for 238 sq in. as set in Calibration Mode})$$

SI Units: 238 sq in. = 1505 cm(2)

The actual volume of replenishment solutions that the REPLENISHMENT system delivers depends on the actual size of the film fed.

The list below describes in more detail the replenishment of the processing solutions.

- If the approximated film area is **less than or equal to 238 sq in.**, the PROCESSOR replenishes the processing solutions when the 3 FILM SENSORS detect the trailing edge of the film.
- If the approximated film area is **greater than 238 sq in.,** the PROCESSOR replenishes the processing solutions twice:
  - when the FILM SENSORS detects 238 sq in.
  - when the FILM SENSORS detect the trailing edge of the film

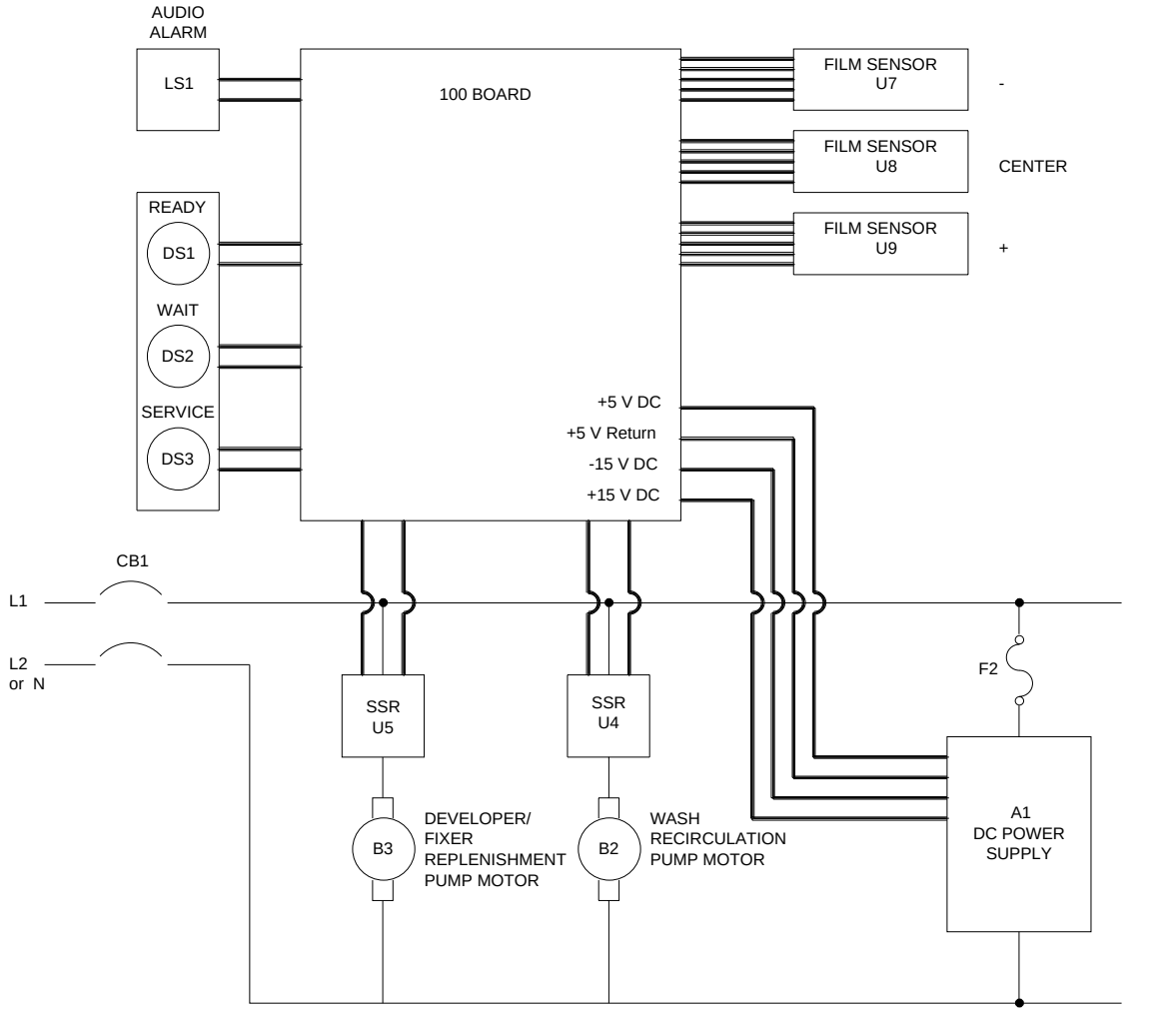
Examples:

If the area of a sheet of 14 x 36 in. tri-fold film (width of film is estimated to be 15.75 in.) is fed into the PROCESSOR, and replenishment is set at 100 mL/238 sq in., the PROCESSOR would deliver the processing solutions as outlined below:

- Approximately 100 mL after the FILM SENSORS detect 15.1 in. of film.
- Approximately 100 mL after the FILM SENSORS detect a total of 30.2 in. of film.
- Approximately 6 mL after the FILM SENSORS detect the trailing edge of the film.

If the operator feeds an 11 x 14 in. sheet of film into the PROCESSOR (14 in. wide), the replenishment system will replenish the processing solutions only once: when the 3 FILM SENSORS detect the trailing edge of the film. Since the approximate area of the film detected (173 sq in.) is **less than 238 sq in.**, the replenishment system only delivers processing solutions when the SENSORS detect the trailing edge of the film. Since the approximate area of the film detected is about 73% of the 238 sq in. required in order to add 100 mL of processing solutions, the replenishment system will deliver about 73% of the processing solutions, or approximately 73 mL.

Figure 12 **The Replenishment Systems**



Replenishment of the Wash Water

Overview

The PROCESSOR can be set in two modes for water replenishment:

- Continous Water Usage Mode
- Low Water Usage Mode

Continuous Water Usage Mode

The PROCESSOR is factory-set in this mode. The INPUT WATER SOLENOID is energized continuously, allowing water to overflow and drain out through the DRAIN VALVE. In this mode, water drains continuously.

Low Water Usage Mode

The PROCESSOR replenishes wash water every time a sheet of film is fed. The PROCESSOR calculates the volume of water to deliver based on 2 factors:

1. the approximate film area detected
2. the volume of water (if any) that the replenishment system delivered for cooling after the last film was fed

If the PROCESSOR needed to add wash water in order to help cool the temperature of the developer solution, the PROCESSOR automatically decreases that amount of water from the total volume of water to deliver for replenishment.

The PROCESSOR supplies 850 mL (28.7 fluid ounces) of water to the RECIRCULATION system whenever the 3 FILM SENSORS detect 1505 cm^2, the area for a 35 x 43 cm sheet of film, (238 sq in., the area for a 14 x 17 sq in. sheet of film) of film passing by the FILM DETECTOR ASSEMBLY. If the operator feeds a sheet of film that has an area less than 1505 cm^2 (238 sq in.), the PROCESSOR replenishes the wash water by supplying a percentage of the 850 mL.

In this mode, you must rotate the DRAIN VALVE KNOBS ¼ turn to drain the water.

Note

Low Water Usage Mode is only recommended in locations where biological growth is not a concern.

Wash Water Control

Wash Control

Any time the operator energizes the PROCESSOR, the WATER INPUT SOLENOID (L1) which controls the incoming wash water, energizes. The WATER INPUT SOLENOID requires 8 minutes to fill the WASH TANK with fresh water. During normal operation, the PROCESSOR adds additional water to aid in the cooling of the developer solution.

45 Second Safety Delay

The WASH RECIRCULATION PUMP does not energize until 45 seconds after the operator energizes the PROCESSOR, even if the operator has already fed a film, or even if the the PROCESSOR requires fresh water to aid in the cooling of the developer solution. The 45 second delay prevents the WASH RECIRCULATION PUMP from operating without water and therefore prevents damage to the PUMP.

Feeding a Film After the "Warm-Up" Period

When an operator feeds a film after the "warm-up" period, the PROCESSOR does not immediately energize the WASH RECIRCULATION PUMP. The WASH RECIRCULATION PUMP does not energize until 55 seconds after the FILM SENSORS detect the leading edge of the film.

- If the operator does not feed additional films, the PROCESSOR de-energizes the WASH RECIRCULATION PUMP 70 seconds after the FILM SENSORS detect the trailing edge of the film.
- If the operator feeds multiple films consecutively, the PROCESSOR energizes the WASH RECIRCULATION PUMP 55 seconds after it detects the first leading edge of film.
- The WASH RECIRCULATION PUMP remains energized until 70 seconds after the PROCESSOR detects the last trailing edge of the film. This is done to limit the length of time that water is flowing through the HEAT EXCHANGER in the DEVELOPER SECTION.

Removing Air from the TUBING

After the 8 minutes, required for the WASH TANK to fill, has elapsed, the PROCESSOR energizes the WASH RECIRCULATION PUMP and the DEVELOPER COOLING SOLENOID (M43 and M43A only) for approximately 20 seconds to remove any air from all TUBING including the HEAT EXCHANGER. During the 20 seconds that the cooling system removes air from the TUBING, the individual parts are operating as outlined:

- the WATER INPUT SOLENOID remains energized
- the DEVELOPER COOLING SOLENOID energizes (M43 and M43A Only)
- the WASH RECIRCULATION PUMP remains energized for an additional 20 seconds

Replenishment Check Mode

The operator can adjust the base replenishment volumes by blocking the FILM SENSORS with film to provide information to the 100 CIRCUIT BOARD.

[1] With the PROCESSOR still energized, remove the TOP COVER of the PROCESSOR. The PROCESSOR will enter the Replenishment Check Mode.

(a) If while the PROCESSOR is in the Replenishment Check Mode you block the middle FILM SENSOR, the ALARM sounds twice and the PROCESSOR adds replenishment solution equal to the preset volume that the PROCESSOR would deliver for a 35 x 43 cm sheet of film or for an area of 1505 cm^2 (14 x 17 in. sheet of film or for an area of 238 sq in.).

(b) The PROCESSOR sounds the ALARM only once if you block either the LEFT or RIGHT FILM SENSOR.

(c) If you block the left FILM SENSOR, the PROCESSOR **decreases** the base replenishment volume by approximately 5 mL for each time you block the SENSOR.

(d) If you block the right FILM SENSOR, the PROCESSOR **increases** the base replenishment volume by approximately 5 mL for each time you block the SENSOR.

Note

For information about how to perform the replenishment check procedure, see the Operator Manual, Publication Number 981089, or the Installation Instructions, Publication Number 981088.

[2] By installing the TOP COVER onto the PROCESSOR, you exit Replenishment Check Mode and return the PROCESSOR to normal operation.

Section 5: ALARM Control

Overview

The AUDIO ALARM beeps to indicate various status conditions of the PROCESSOR.

- Normal Operating Conditions
  - that the PROCESSOR successfully completed a “Power On Self Test” (POST) upon being energized
  - that the PROCESSOR can accept a second sheet of film
  - that a warning condition exists
- In Replenishment Check Mode
  - that 1 of the FILM SENSORS detects a sheet of film
- Error Condition
  - that the PROCESSOR has detected an error or warning condition that requires attention

ALARMS Heard During Normal Operating Conditions

The PROCESSOR’S AUDIO ALARM beeps 3 times when the operator first energizes the PROCESSOR. The AUDIO ALARM then beeps as a film feeding signal to the operator whenever the FILM SENSORS have detected the presence of film. The film feeding signal consisting of 1 beep that lasts for a full second, sounds 6 seconds after the FILM SENSORS detect the trailing edge of a sheet of film. The beep actually indicates a couple of possible operator responses:

- that the operator may feed a second sheet of film into the PROCESSOR
- that the operator may turn on the darkroom lights if he or she does not have any more film to process

The 6 second delay allows sufficient distance between films to prevent the films from overlapping in the various sections of the PROCESSOR. By not allowing the films to overlap, the operator is taking steps to avoid the under development of those films and film transport problems.

ALARMS Heard During Warning Conditions

The AUDIO ALARM may also beep to indicate a warning condition or an error that the operator can correct. If the operator attempts to feed a sheet of film into the PROCESSOR before correcting the warning or error condition, the ALARM will beep twice when the PROCESSOR detects the leading edge of a sheet of film.

ALARMS Heard During Fatal Error Conditions

If the PROCESSOR detects a fatal error after an operator feeds a sheet of film, the ALARM beeps on for 2 seconds and off for 2 seconds until the sheet of film exits into the RECEIVING BIN.

ALARMS Heard While the PROCESSOR Is In The Replenishment Check Mode

When the PROCESSOR is in the Replenishment Check Mode, the ALARM beeps on 2 occasions:

- when the PROCESSOR increments or decrements the replenishment rate, the ALARM beeps once
- when the PROCESSOR energizes the REPLENISHMENT PUMPS, the ALARM beeps twice

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